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Tuvan Reduplication and Harmony

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0. Introduction

In this paper we present new data on reduplication in Tuvan, a Turkic language of south Siberia.¹ Output forms generated by this morphological rule reveal the operation of phonological constraints that are not apparent in the regular lexicon and morphology of Tuvan. We found that speakers exhibited considerable phonological variation in the production of reduplicants. We attribute this variability to speakers' indeterminate ranking of general markedness constraints in the language. Reduplication also yields output forms in which rounding harmony fails to apply even though all conditions for its application are present. We argue that certain of the constraints responsible for rounding harmony may emerge in novel contexts, though these constraints exert no observable effects anywhere else in the language. We claim that such constraints, which may remain dormant or inactive in the standard lexicon and morphology, can emerge and apply robustly in more marginal areas of the language such as reduplicants and loanwords. We shall refer to such constraints as being "inactive." Our investigation of Tuvan reduplication provides evidence for a rounding harmony constraint which is attested cross-linguistically, but which remains inactive in Tuvan and surfaces only under special conditions. We model the proposed constraints within the framework of Optimality Theory (Prince and Smolensky 1993) to show how variable rankings account for variation in output.

1. Tuvan reduplication

Tuvan has a morphological rule of full reduplication that signals either intentional vagueness or an informal, jocular register. The rule reduplicates the entire base while replacing the vowel of the initial syllable, usually with either [a] or [u] (hereafter referred to as "replacement vowels"). For reference, we present the Tuvan vowel inventory.

(1) Tuvan Vowels:	i	ü	ɨ	u	ii	üü	ïï	uu
	e	ö	a	o	ee	öö	aa	oo

Monosyllabic words are reduplicated as follows:

(2)	<u>base</u>	<u>base + reduplicant</u>	<u>gloss</u>
	<i>nom</i>	<i>nom-nam</i>	'book'
	<i>er</i>	<i>er-ar</i>	'male'
	<i>eet</i>	<i>eet-aat</i>	'river delta'
	<i>is</i>	<i>is-as</i>	'footprint'

<i>ög</i>	<i>ög-ag</i>	'yurt'
<i>siit</i>	<i>siit-sat</i>	'milk'
<i>qis</i>	<i>qis-qas</i>	'girl'
<i>xol</i>	<i>xol-xal</i>	'hand'
<i>at</i>	<i>at-ut</i>	'name'
<i>aar</i>	<i>aar-uur</i>	'heavy'

This simplified data set shows that all vowels except [a] are replaced by [a], while [a] is replaced by [u]. Except for the replacement vowel, the above reduplicants are identical to the bases from which they derive (we omit minor consonant alternations herein). We assume the base and reduplicant to be related by a faithfulness constraint (McCarthy and Prince 1995). This ensures that—modulo other constraints—they will resemble each other as closely as possible:

- (3) FAITH-BAS.RED *the reduplicant must be identical to the base*

Apart from their replacement vowels, monosyllabic reduplicants are identical to bases. The reduplication rule must introduce a higher-ranked, anti-faithfulness constraint (cf. Kelepir 1999). This constraint, which must be specific to Tuvan, not universal, dictates that the first vowel of the base and replacement vowel must differ from one another:

- (4) *IDENT-BAS.RED(V1) *replacement vowel must differ from base vowel*

These two constraints alone account for the data presented so far. But the reduplicant becomes considerably less faithful when the base is polysyllabic:

(5) <u>base</u>	<u>base + reduplicant</u>	<u>gloss</u>
<i>idik</i>	<i>idik-adik</i>	'boot(s)'
<i>inek</i>	<i>inek-anak</i>	'cow'
<i>ulu</i>	<i>ulu-ali</i>	'dragon'
<i>ari</i>	<i>ari-uru</i>	'bee'
<i>nomdzuur</i>	<i>nomdzuur-namdziir</i>	'read'
<i>oktaan</i>	<i>oktaan-uktaan</i>	'throw'-PAST
<i>uduur</i>	<i>uduur-adiir</i>	'sleep'-FUT

In these forms, vowels change in both initial and post-initial syllables. Changes to post-initial vowels of the base do not result directly from reduplication, but from the application of backness and rounding harmony to the reduplicant. Harmony constraints (described below) thus outrank base-reduplicant faithfulness. Reduplication 'feeds' backness and rounding harmony by providing a new initial-

syllable vowel which may potentially trigger harmony. For example, the reduplicant of the word for 'bee', *ari*, surfaces as *ari-uru*, not **ari-uri*. Reduplication may also 'bleed' Rounding harmony: in *ulu* 'dragon,' the rule introduces an unrounded replacement vowel and the reduplicant is thus *ulu-ali* rather than **ulu-alu*. In the absence of such feeding and bleeding effects, post-initial vowels do not change. The vowel [aa] in *oqtaan-uqtaan* 'threw'-REDUP remains unaltered because it is already [+back] and is not a potential target for rounding harmony (cf. section 3 below).

2. Backness harmony

Backness harmony operates on the natural vowel classes defined by the feature [+/-back], and requires all the vowels in a word to agree in backness. Since reduplicants always contain either [a] or [u] in the first syllable, it follows that they are always composed entirely of back vowels.² Backness harmony applies such that all front vowels in the base change to their back counterparts in the reduplicant. Thus *idiktiy* 'boot' becomes *idiktiy-adiqtiy*.

3. Rounding harmony

Tuvan rounding harmony (hereafter RH) requires a high vowel to be rounded if it follows a rounded vowel. RH makes reference to the features [+round] and [+/-high]. In an autosegmental analysis (Clements and Sezer 1982), the feature [round] may be construed as spreading rightward from any round vowel to any adjacent high vowel. RH targets high vowels [i] and [ɨ] and yields high rounded vowels [ü] and [u] as outputs. RH obtains robustly without regard to height or backness of trigger vowels. Any rounded vowel serves as a trigger. Allophonic variations in high vowel suffixes such as the third singular possessive /-(z)V/ demonstrate most clearly the operation of rounding harmony (suffix vowels targeted by RH are underlined):

(6)	<u>lexeme</u>	<u>suffix</u>		<u>gloss</u>
	<i>af</i> <u>a</u>	- <u>zi</u>	*-zu	'father'-3
	<i>iz</i>	- <u>i</u>	*-ü	'footprint'-3
	<i>to</i> <u>l</u>	- <u>u</u>	*-i	'story'-3
	<i>xo</i> <u>l</u>	- <u>u</u>	*-i	'hand'-3
	<i>xö</i> <u>l</u>	- <u>ü</u>	*-ü	'lake'-3
	<i>bü</i> <u>rü</u>	- <u>zi</u>	*-zi	'wolf'-3

Were RH to under- or over-apply, outputs such as **iz-u* or **xol-i* would be possible. In fact, such forms are never attested in the lexicon and morphology of Tuvan and are judged by speakers to be ill-formed.

Tuvan RH exhibits the property of unboundedness (Anderson 1980). [+round] spreads any distance within a word span to adjacent target vowels (underlined):

(7)	<i>xög</i> <u>züm</u> - <u>t</u> <i>f</i> <u>ü</u> - <u>n</u> <i>ü</i>	'music'-AGENT.ACC
	<i>to</i> <u>l</u> - <u>d</u> <i>z</i> <u>u</u> - <u>l</u> <i>u</i> <u>y</u>	'story'-AGENT.COMIT

We stated earlier that RH obtains robustly without regard to height or backness of trigger vowels. Crucially for our analysis, RH also obtains without regard to length of target or trigger (targets underlined).

(8)	<u>trigger</u>	<u>target</u>	<u>word</u>	<u>gloss</u>
	long	short	<i>oo<u>ʒ</u>um</i>	'slow(ly)'
	long	short	<i>boo-<u>ʒ</u></i>	'gun'-3
	short	short	<i>u<u>d</u>up</i>	'sleep'-CV
	short	short	<i>ulu-<u>ʒ</u></i>	'dragon'-3
	short	long	<i>u<u>r</u>uu</i>	'daughter'-3
	short	long	<i>idii-<u>u</u>uu</i>	'boot'-3-REDUP-3
	long	long	<i>toor<u>u</u></i>	'sunflower.seed'-3

These facts suggest that length plays no apparent conditioning role in the application of Tuvan RH. This is not the case in the Tungus languages Bayinna Oroch (Li 1996) and Evenki (Nedjalkov 1997), or in Daur Mongolian (Wu 1996) where long vowels fail to trigger RH, although they consistently undergo it. Shortness of trigger vowels thus seems to be a factor favoring harmony. We know of no languages where long vowels trigger RH but short vowels do not. The relationship between trigger goodness and length is implicational: if long vowels are good RH triggers in a given language then short vowels are too. The reverse is not true. A constraint that spreads rounding from short vowels would thus seem to be universally ranked above one that spreads from long vowels. We propose the following constraints to account for quantity-sensitive RH as attested in Evenki, Bayinna Orochen and Daur:

(9) Quantity-sensitive RH constraints

- i. SPREAD[RD]/V *Spread [+round] from a short vowel*
- ii. SPREAD[RD] *Spread [+round]*

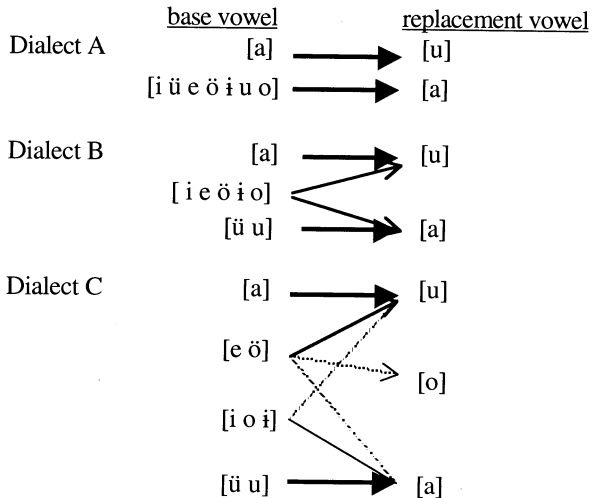
In the normal application of Tuvan RH, there is no evidence for the separability of these two constraints. They pattern together in all areas of the lexicon and affixal morphology, spreading rounding from all rounded trigger vowels. Since the set of constraints is thought to be universal, however, we should conclude that (9i) and (9ii) do indeed remain distinct in Tuvan, but never pattern distinctly. It is uniquely in the context of reduplication, as we will show, that these constraints may fail to apply in an identical manner.

4. Variability in output

The true complexity of Tuvan reduplication becomes apparent in the many dialect and individual versions of the rule. The author documented reduplication patterns for thirty-five individual speakers. Three types of data were collected: (i)

spontaneous instances of reduplication from speech; (ii) elicited reduplicated forms; (iii) speakers' judgments of well-formedness of reduplicants proposed by the author or produced by other speakers. Speakers' production of reduplicants may be classified into one of three basic patterns (dialect groups) according to the number of possible replacement vowels they employ (either two or three), and the degree of flexibility in mapping inputs to output. In the schema below, bold lines denote more robust mapping patterns, while plain and dotted lines denote less robust ones.

(10) Mapping of base (input) vowel to replacement (output) vowel

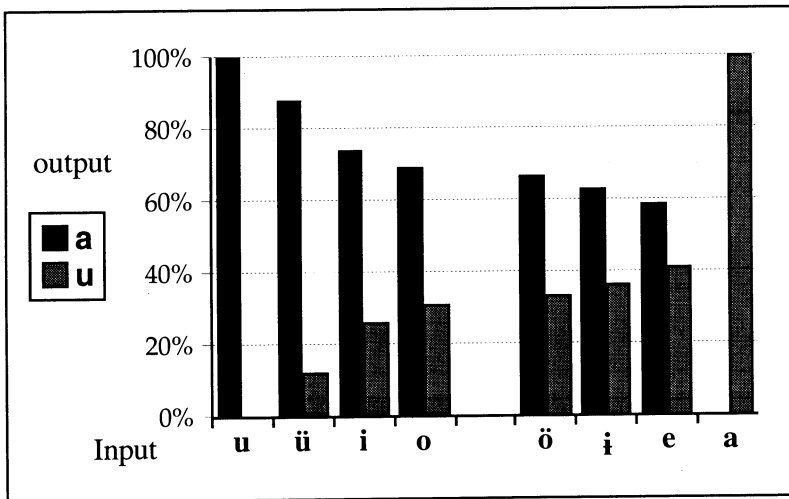


Dialect A (spoken in Kyzyl, Tuva), has only two replacement vowels and invariable mapping of inputs to outputs. Speakers of this dialect do not accept any alternative outputs as well-formed. Dialect B (spoken in central Tuva) also has two output vowels, but speakers show flexibility in mapping mid vowels and high unrounded vowels to either [a] or [u]. Speakers usually have an opinion about whether [a] or [u] is better, with an overall preference for [a]. Dialect C, (of the Süt-xöl region of Tuva), includes [o] as a replacement vowel, and shows even greater flexibility in mapping input to output. Dialect A is maximally simple and therefore less interesting, while dialect C has not yet been fully documented and is left for further research. The remainder of this paper will thus be primarily concerned with dialect B, which includes a number of regional variants of spoken Tuvan. For a speaker of dialect B or C, more than one well-formed reduplicant may be derived from a single base. Under (11) we see some of the various reduplicants produced by a single speaker of dialect B.

(11) <u>base</u>	<u>base+reduplicant I</u>	<u>base+reduplicant II</u>	<u>gloss</u>
<i>xol</i>	<i>xol-xul</i>	<i>xol-xal</i>	'hand'
<i>ök</i>	<i>ök-ak</i>	<i>ök-uk</i>	'button'
<i>is</i>	<i>is-as</i>	<i>is-us</i>	'footprint'
<i>er</i>	<i>er-ar</i>	<i>er-ur</i>	'male'
<i>öörenip</i>	<i>öörenip-aaranip</i>	<i>öörenip-uuranip</i>	'study'-CV
<i>ekkep</i>	<i>ekkep-ukkap</i>	<i>ekkep-akkap</i>	'bring'-CV
<i>ezim</i>	<i>ezim-uzum</i>	<i>ezim-azim</i>	'friend'-1

The relation of input (base) vowels to output (replacement) vowels are shown in the histogram (12), which represents the composite output of ten speakers of dialect B (421 tokens). The horizontal axis shows the base vowels which serve as input to the rule. The vertical bars show outputs (replacement vowels) for each given input. Dark colored bars show the percentage of tokens for which [a] emerged as replacement vowel, and gray colored bars show how often [u] emerged.

(12) Choice of replacement vowel for ten speakers (dialect B)



When the base contained [u], the reduplicant had [a] one hundred percent of the time. The same proportion held true for input [a]. All other input vowels varied in their output. Speakers showed an overall preference for [a], but [u] also appeared robustly as an alternative. I argue that the ratio of [a] to [u] in the output reflects speakers' uncertainty as to the relative markedness of these vowels. It also reflects the fact that the reduplication rule requires at minimum two replacement vowels, so both [a] and [u] are valid choices, even though [u] is more marked.

5. Variability and markedness

The reduplication rule as we have formulated it does not specify the quality of the replacement vowel. This can be shown, we believe, to fall out from general principles of the grammar. A markedness hierarchy among vowels might best account for the proportional occurrence of [a] and [u]. Cross-linguistically, [a] is the least marked vowel, and thus it is not surprising that [a] emerges most frequently as output. But [a] alone is insufficient to satisfy condition (i), since at least two replacement vowels are needed. The next best choice appears to be [u], if we limit the output to back vowels. Since [o] and [i] are both highly marked, the proposed markedness hierarchy [a] > [u] > [o] > [i] for back vowels is at least a plausible one.³ The exact realization of markedness principles in Tuvan is left for further research. For now, we represent Tuvan markedness as a single constraint, *MARKED, requiring speakers to avoid marked segments.

6. The status of [round] in Tuvan

Front rounded vowels, of which Tuvan has two, are rare from a cross-linguistic perspective (Maddieson 1984). In a vowel inventory that has both front rounded vowels and back unrounded vowels, the feature [round] is not reinforced by the feature [back] as in English. Such reinforcement is referred to as enhancement (Stevens, Kaiser and Kawasaki 1986). Enhancement of one feature by another may serve to make contrasts among vowel qualities more salient. We propose that distinctive rounding without backness enhancement is a potentially difficult feature, not only in Tuvan but in languages in general (Kaun 1995).

Languages may employ various strategies for dealing with difficult contrasts. First, languages may employ positional neutralization (Steriade 1995) to limit such contrasts to prominent syllables. Tuvan, like most Turkic languages, restricts contrastive rounding to initial syllables. Low rounded vowels [ö] and [o] never appear post-initially. High rounded vowels [ü] and [u] appear post-initially only when generated by harmony, making rounding a fully predictable feature in post-initial syllables.

A second strategy for difficult features is to extend their domain by spreading them. This can be done with vowel harmony, which spreads a feature across the word span. It is probably not a coincidence that languages that spread [+round] via rounding harmony tend to have both front rounded vowels and back unrounded vowels in their inventories. The spreading strategy may thus be advantageous in vowel systems such as Tuvan where rounding is not enhanced by backness.

7. Variation in applying RH

We conclude that the constraints responsible for rounding spread are virtually undominated in Tuvan. Nowhere in the lexicon, borrowed lexicon, or morphology does RH fail to apply when the triggering conditions are met. Given the robust and pervasive nature of Tuvan RH, it is somewhat surprising that the output of reduplication provides unique examples of forms where rounding harmony fails to apply even though conditions for it appear to be present.

(13) <u>base</u>	<u>base+reduplicant I</u>	<u>base+reduplicant II</u>	<u>gloss</u>
	RH obtains	RH fails	
<i>azi</i>	<i>azi-uzu</i>	* <i>azi-uzi</i>	'if'
<i>ari</i>	<i>ari-uru</i>	* <i>ari-uri</i>	'bee'-3
<i>aazi</i>	? <i>aazi-uuzu</i>	<i>aazi-uuzi</i>	'mouth'-3
<i>aari</i>	? <i>aari-uuru</i>	<i>aari-uuri</i>	'burden'-3

For all speakers, *azi* 'if' is reduplicated as *azi-uzu*, with obligatory rounding harmony. But the nearly homophonous form *aazi* 'mouth'-3 is, for many speakers, reduplicated as *aazi-uuzi* without rounding harmony. Underapplication of RH can occur only if the triggering vowel is long. This effect is quite robust in reduplicants, but does not surface anywhere else in Tuvan.

Viewed from a cross-linguistic perspective, rounding harmony is frequently seen to be conditioned by various phonological features of the target and trigger (e.g. height or backness). The highly conditioned nature of many harmony systems can be best modeled as a family of constraints. These constraints may refer to various features of targets and triggers.

We suggested earlier that rounding harmony may be perceptually motivated as a strategy for dealing with a difficult contrast such as unenhanced rounding. We will now capitalize on that notion by proposing that it may be more crucial to spread the feature [round] from a short vowel than from a long one. A long vowel has greater perceptual salience, and may be better able to support a difficult contrast. This hypothesis provides the motivation for the two RH constraints proposed in (10).

Our formal model of Tuvan reduplication and RH relies on five constraints:

- (14) *IDENT-BAS.RED(V1) *base vowel must differ from replacement vowel*
 FAITH-BAS.RED *reduplicant should be identical to base*
 *MARKED *avoid marked segments (*i, *o)*
 SPREAD[RD]/V *spread [+round] from a short vowel*
 SPREAD[RD] *spread [+round]*

The full range of attested Tuvan reduplication patterns can be readily generated by the appropriate rankings of these constraints. For example, speakers showed three different patterns of RH from a long trigger:

- (15)
- | | <u>base</u> | <u>base+reduplicant</u> | |
|-------------------------|----------------|--|-----------|
| speaker 1 (RH) | <i>taaqp̄i</i> | <i>taaqp̄i-tuuqp̄u</i> | 'tobacco' |
| speaker 2 (no RH) | <i>taaqp̄i</i> | <i>taaqp̄i-tuuqp̄i</i> | |
| speaker 3 (optional RH) | <i>taaqp̄i</i> | <i>taaqp̄i-tuuqp̄u</i> or <i>taaqp̄i-tuuqp̄i</i> | |

Speaker 1 represented a minority of those we surveyed. His spreading of round was quite consistent regardless of the length of the trigger. We model this behavior with the following constraint ranking:

- (16) Speaker 1 **always spreads** rounding from a long trigger vowel in reduplicants. SPREAD[RD] outranks FAITH-BAS.RED, while SPREAD[RD]/V plays no decisive role:

aazi 'mouth'-3	*i, *o	*IDENT-BAS.RED (v1)	SPREAD [RD]/V	SPREAD [RD]	FAITH- BAS.RED
aazi-aazi		* !			
aazi-uuzi				* !	*
aazi-uuzu					* *
aazi-aaza		* !			*
aazi-iizi	* !				* *

Most speakers we surveyed were like speaker 2, in that they always applied RH when the trigger was short, but consistently failed to apply RH when the trigger was long. The effect we describe is thus quite robust, though absent from the regular lexicon and morphology of the language.

- (17) Speaker 2 **never spreads** rounding from a long trigger vowel in reduplicants. FAITH-BAS.RED outranks is interspersed between the RH constraints.

aazi 'mouth'-3	*i, *o	*IDENT-BAS.RED (v1)	SPREAD [RD]/V	FAITH- BAS.RED	SPREAD [RD]
aazi-aazi		* !			
aazi-uuzi				*	*
aazi-uuzu				* * !	
aazi-aaza		* !		* *	
aazi-iizi	* !			* *	

Finally, speaker 3 **optionally spreads** rounding from a long trigger vowel in reduplicants. We found such speakers consistently able to alternate between forms with RH and forms without RH, thus employing both of the above rankings.

In the case of reduplicants with short vowel harmony triggers, all speakers consistently applied RH, and judged proposed forms without RH to be ill-formed.

(18) Speakers **always** spread rounding from short trigger vowels in reduplicants. SPREAD[RD]/V outranks base-reduplicant faithfulness, while SPREAD [RD] plays no active role.

azi 'if'	*i, *o	*IDENT-BAS.RED (v1)	SPREAD [RD]/V	SPREAD [RD]	FAITH- BAS.RED
azi-azi		*!			
azi-uzi			*!		*
azi- uzu					* *
azi-aza		*!			*
azi-ozı	*!		*		*
azi-ozu	*!				* *
azi-izi	*!				*

8. Discussion

Tuvan speakers have no evidence from the regular lexicon and morphology of their language that RH may fail to obtain when the potential trigger is long. Such cases are unattested in the standard language. Yet in novel contexts, when called upon to apply the reduplication rule, speakers produce forms in which RH fails to apply precisely when the trigger is long. The underapplication of RH when all conditions for it are present is clearly an anomaly in Tuvan. This output reflects "on-line" decisions made by speakers about the ranking of RH constraints relative to faithfulness constraints which are otherwise inactive.

We propose that phonotactic constraints that may be entirely dormant or have no active role in the native lexicon or morphology of a language can nonetheless surface and play an active role in more marginal or novel areas of a language such as word games, reduplicants, and loanwords. When these hidden phonological constraints do come into play, speakers may exhibit some uncertainty about their ranking, or may assign them a novel ranking. The assigned ranking can have the effect of demoting other constraint(s) that would otherwise be dominant.

In the case discussed herein, a sizeable number of speakers appears to be able to demote one of the RH constraints, causing RH to fail in some cases. In demoting this constraint, they effectively break up the family of RH constraints, which everywhere else in the language pattern as a uniform block. This raises theoretical issues about the behavior and (non)uniform patterning of constraint families.

The generally dormant or inactive status of the base-reduplicant faithfulness constraint and the fact that it becomes active only under reduplication, may account for speakers' uncertainty about its ranking. Clearly, no consensus has yet been reached in the speech community about where this constraint should rank relative to RH constraints. Dialectal and individual differences in ranking persist. Furthermore, many speakers seem content to employ at least two alternative rankings on different occasions, and do not seem to be in rush to assign a ranking. This raises important issues about the stability of variable constraint rankings and speakers' tolerance for uncertainty.

Notes

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² Exceptions to this generalization are disharmonic loanwords such as [radiyo] 'radio', which are common in Tuvan (Anderson and Harrison, forthcoming). The patterning of disharmonic forms under reduplication raises a number of important theoretical issues, which are discussed in a separate paper. See (Harrison, forthcoming)

³ Establishing a markedness hierarchy for the vowels of a language is a difficult theoretical and empirical problem. In proposing a tentative hierarchy for Tuvan vowels, we considered the following factors: (i) frequency of segments across languages, (ii) frequency of segments in Tuvan, (iii) alternations in productive morphology, (iv) positional neutralization, (v) acoustic values (central vs. peripheral), and (vi) the facts of reduplication.

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